

Aerosol Microphysics and Optics during TRACE-P and ACE-Asia

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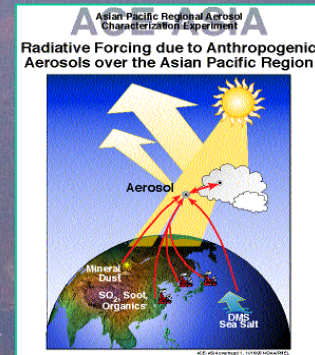
- TRACE-ACE Comparison Flights

- P3B – DC8 Comparison

- Nucleation in Yellow SEA

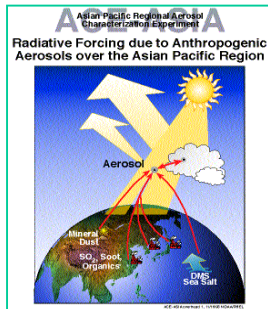
- Aerosol Optics & Links to Models and Satellites

- Aerosol-Gas Regional Characteristics





Light Scattering TRACE / ACE Comparison flight 3/31/01

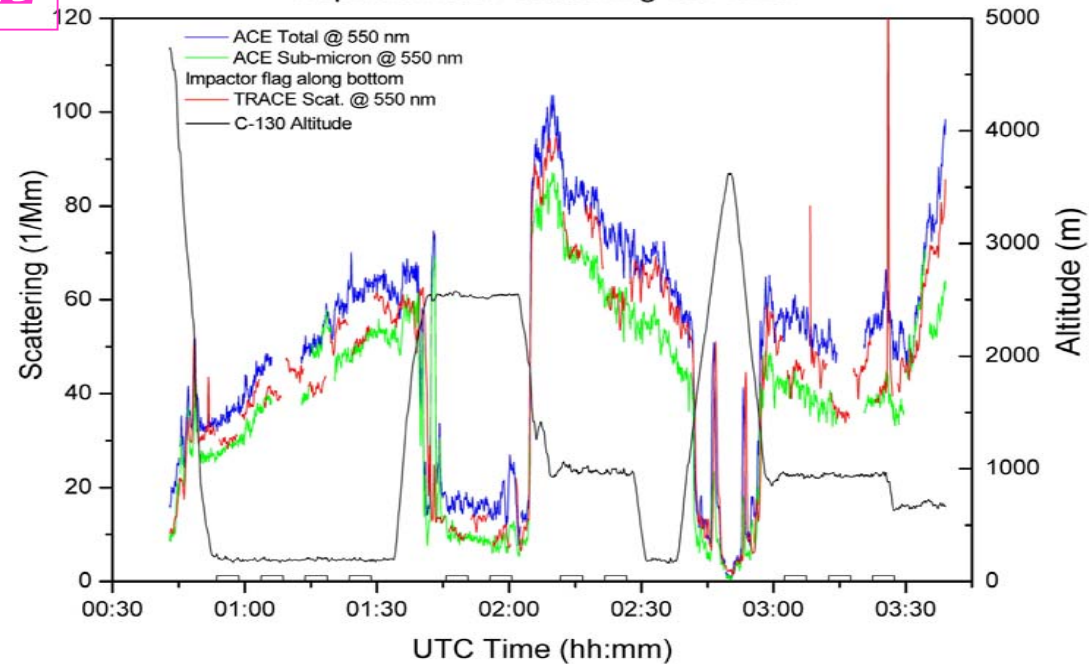


P3B TRACE and C-130 ACE

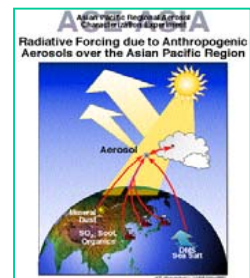
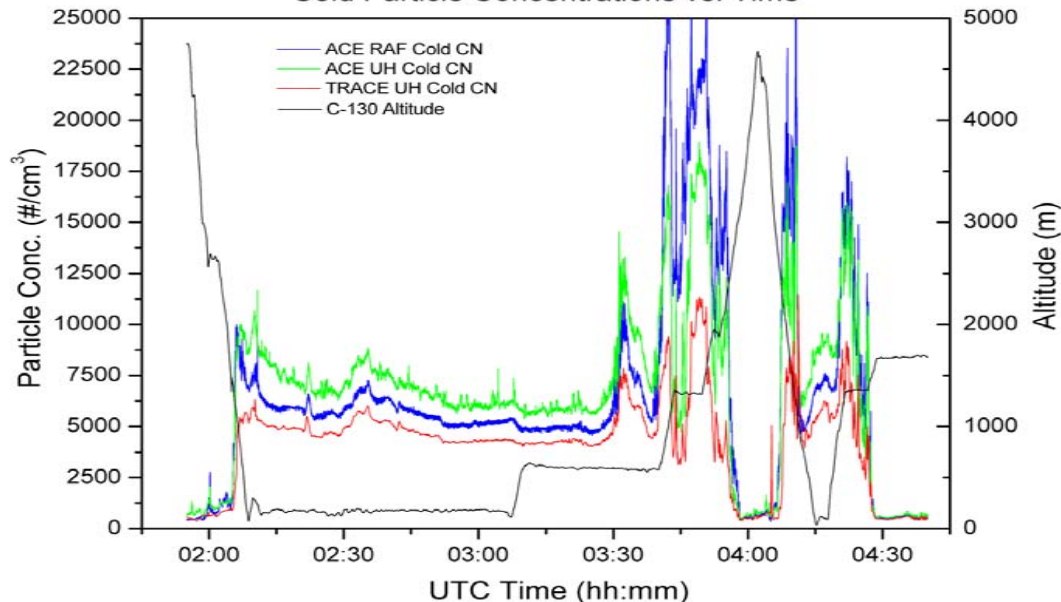
TRACE cycling between total and submicron scatter (red) agrees with ACE continuous total (blue) and fine (green) scatter.

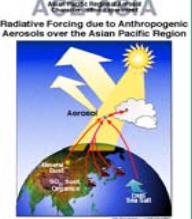
TRACE and ACE CN data track well but differ by greater than the 10% flow difference.

ACE-Asia RF01 - TRACE-P RF18
Nephelometer Scattering vs. Time

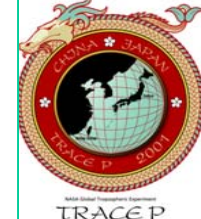


ACE-Asia RF02 - TRACE-P RF19
Cold Particle Concentrations vs. Time





Uncorrected Thermal DMA Number distributions

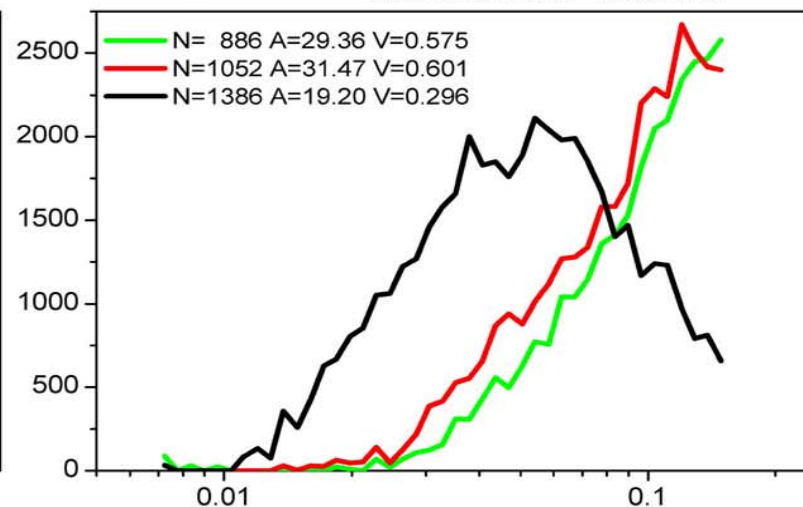
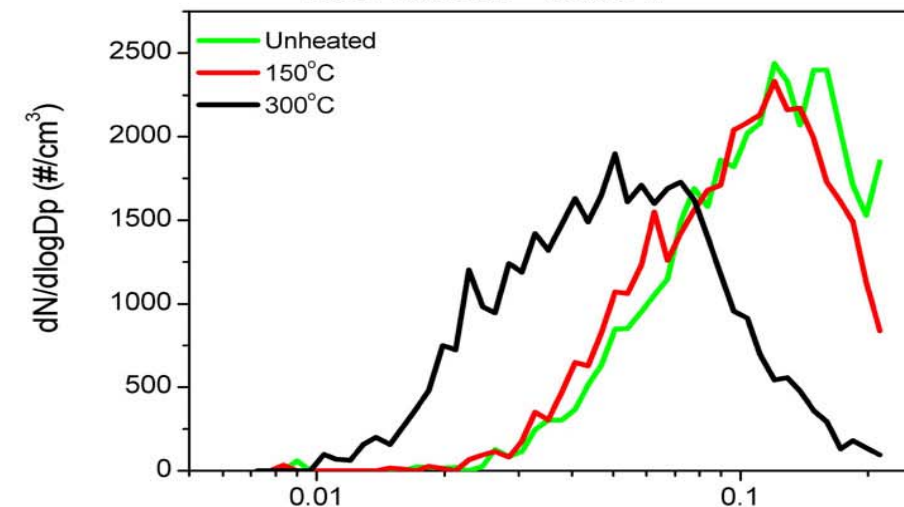


ACE RF01 - TRACE RF18

UH DMA Scans

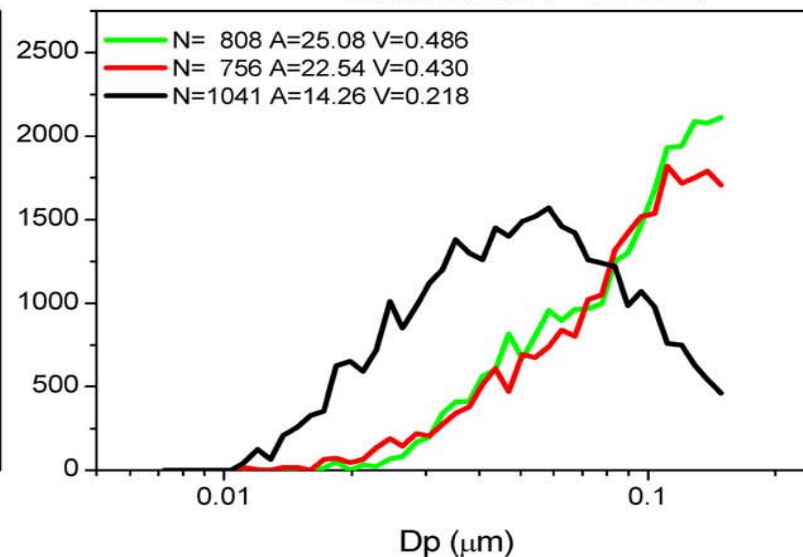
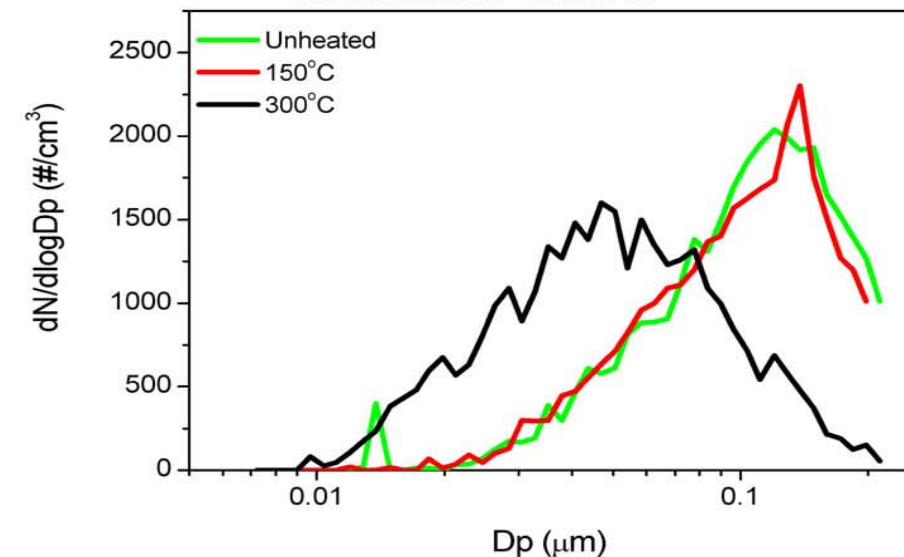
ACE-Asia
Scan 03:03:27 - 03:03:47

TRACE-P
Scan 03:04:22 - 03:04:42



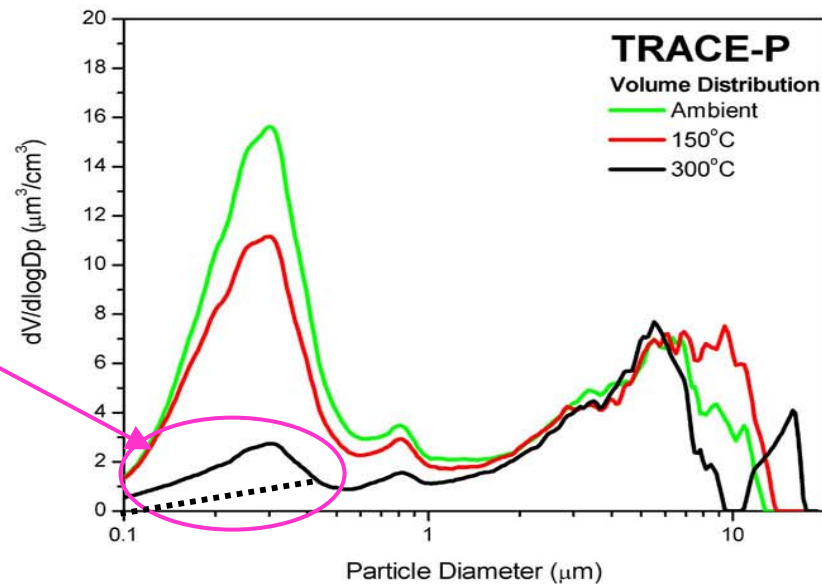
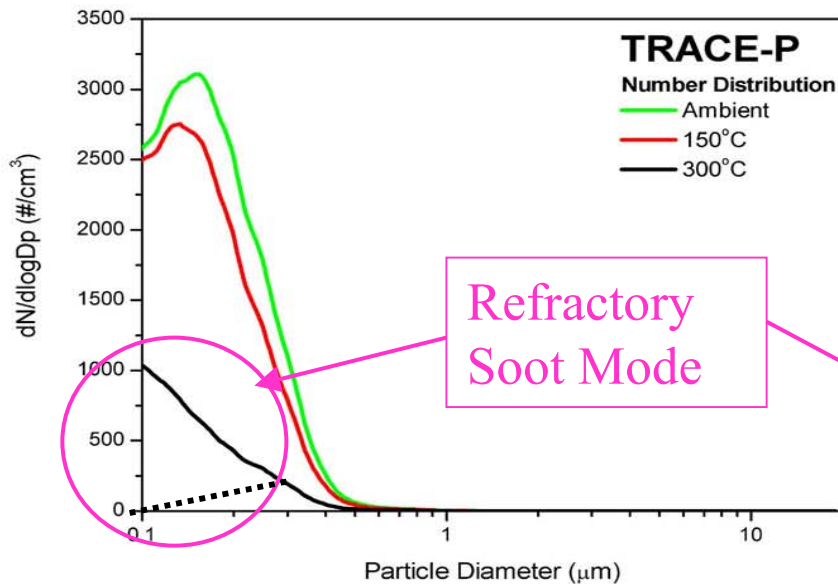
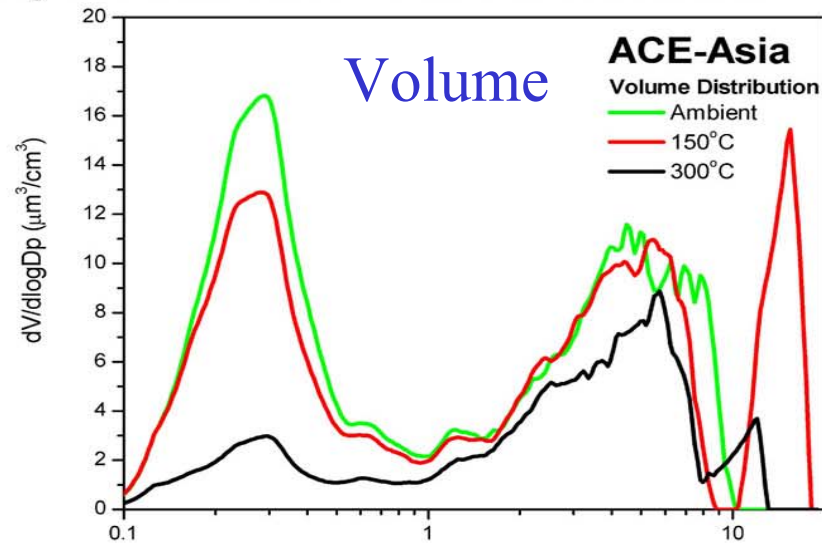
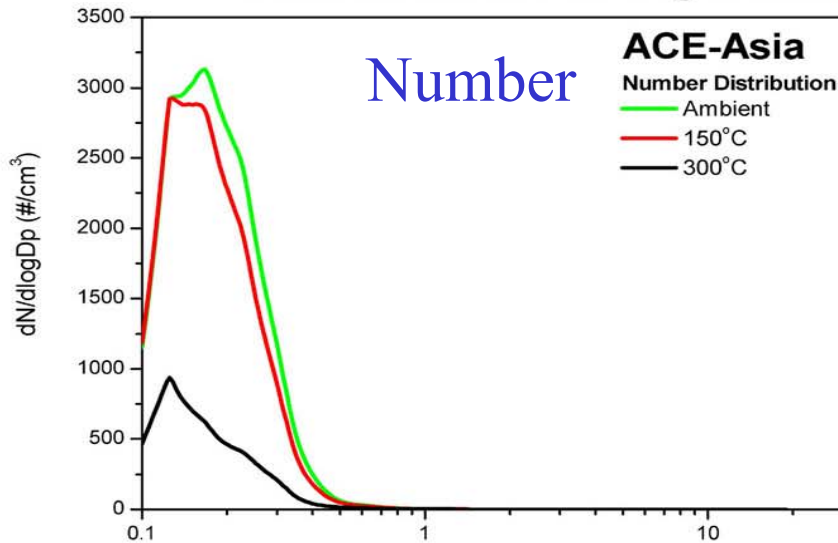
ACE-Asia
Scan 03:15:56 - 03:16:16

TRACE-P
Scan 03:15:14 - 03:15:34



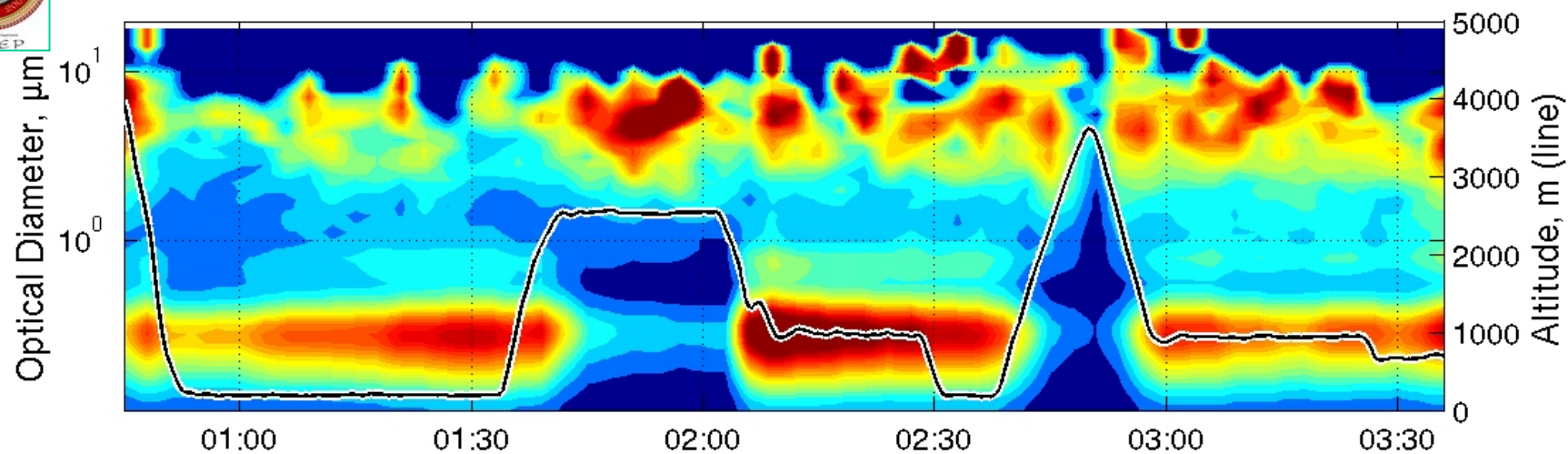
RF01 - UH OPC Number and Volume Distributions

Distributions are for Leg 2 Heading SW from 00:53 - 01:34 at 190 meters

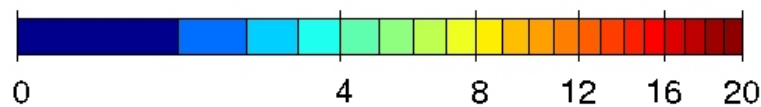
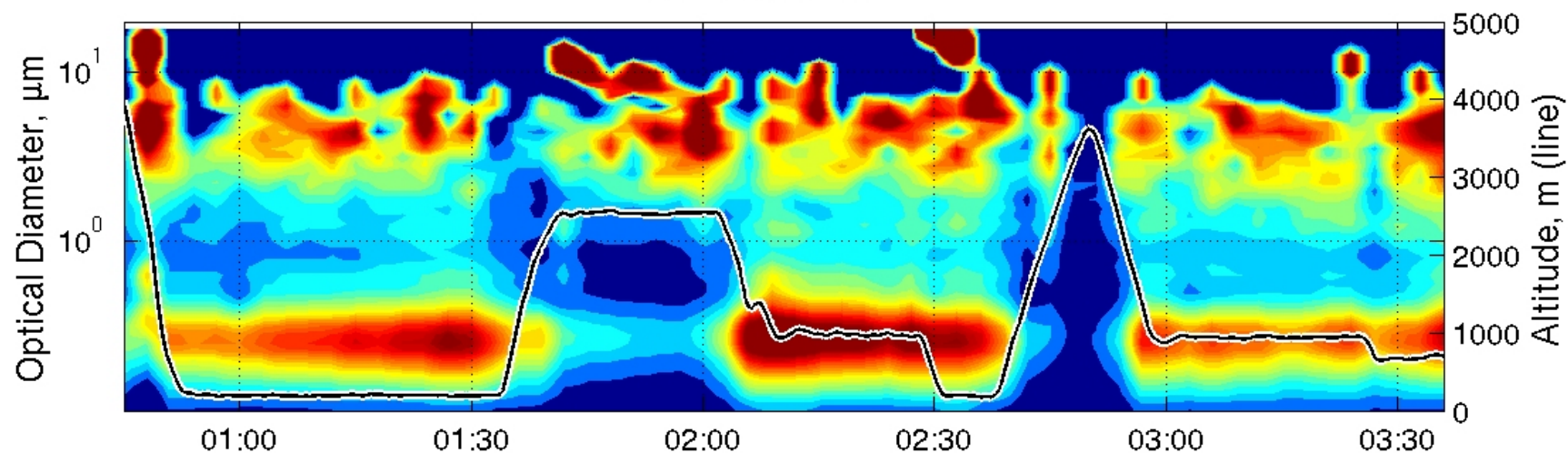




TRACE-P OPC



ACE-Asia OPC



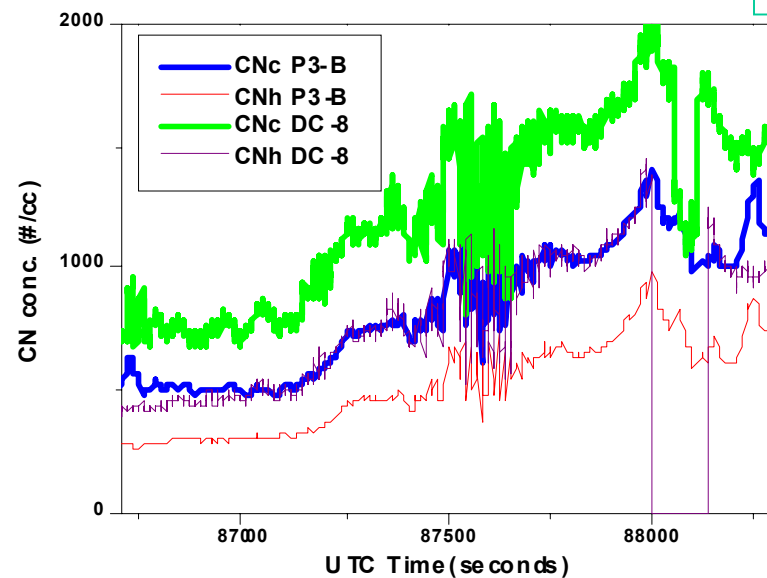
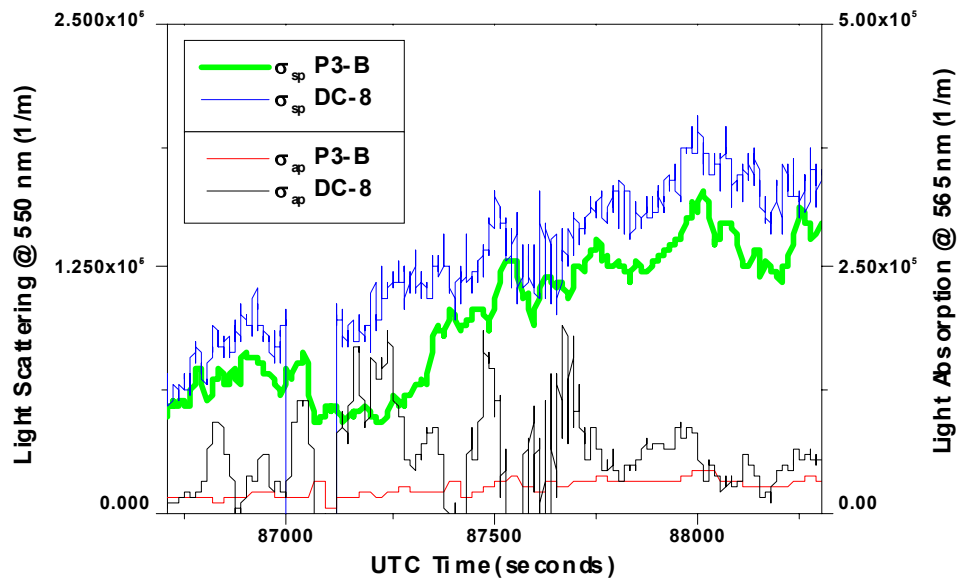
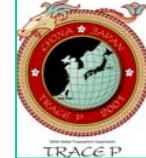
$dV / d \log D, \mu m^3 cm^{-3}$



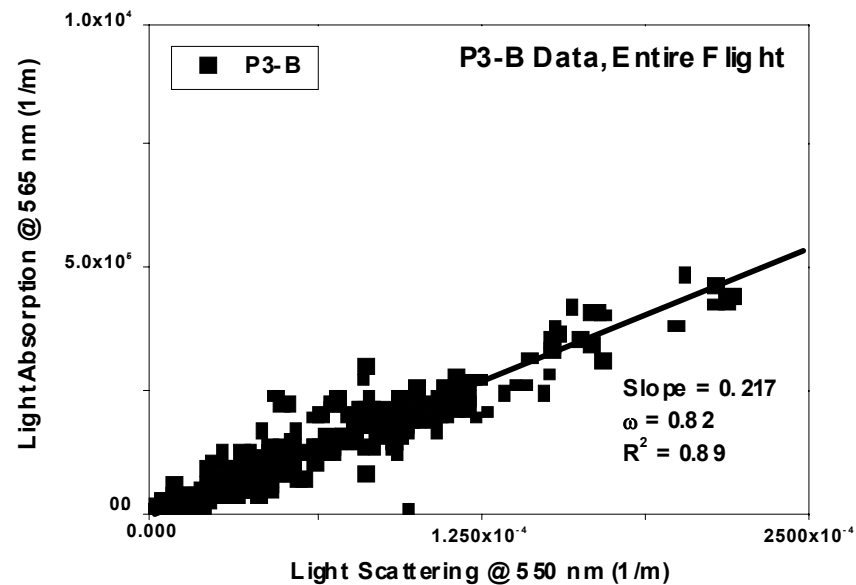
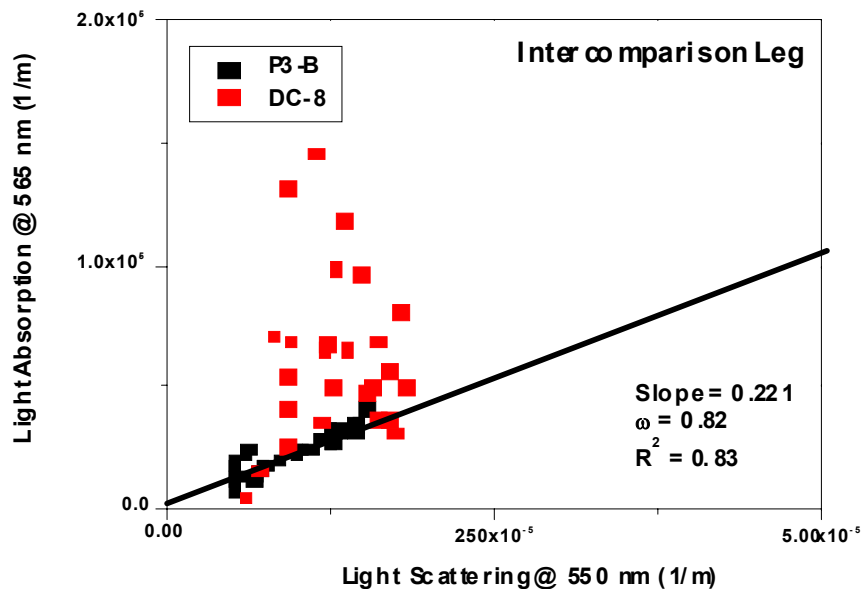
P3B - DC8

TRACE P 2 nd Intercomparison, Yakota Japan

P3-B flt 16 and DC-8 flt 14 @ 5.16 km



Note: Corrections for σ_{sp} & σ_{ap} not applied for P3-B or DC-8



The following shows agreement between measured and modeled fine, coarse and total particle extinction coefficients as calculated from the size distributions. These are then integrated over the column to get optical depths for coarse, fine and total aerosol optical depth including the spectral wavelength dependence.

IN THIS FASHION, BOTH OUR ACE AND TRACE DATA CAN BE LINKED DIRECTLY NOT ONLY TO MODEL PRODUCTS BUT ALSO SPECTRAL OPTICAL COLUMN PROPERTIES MEASURED BY SATELLITES.

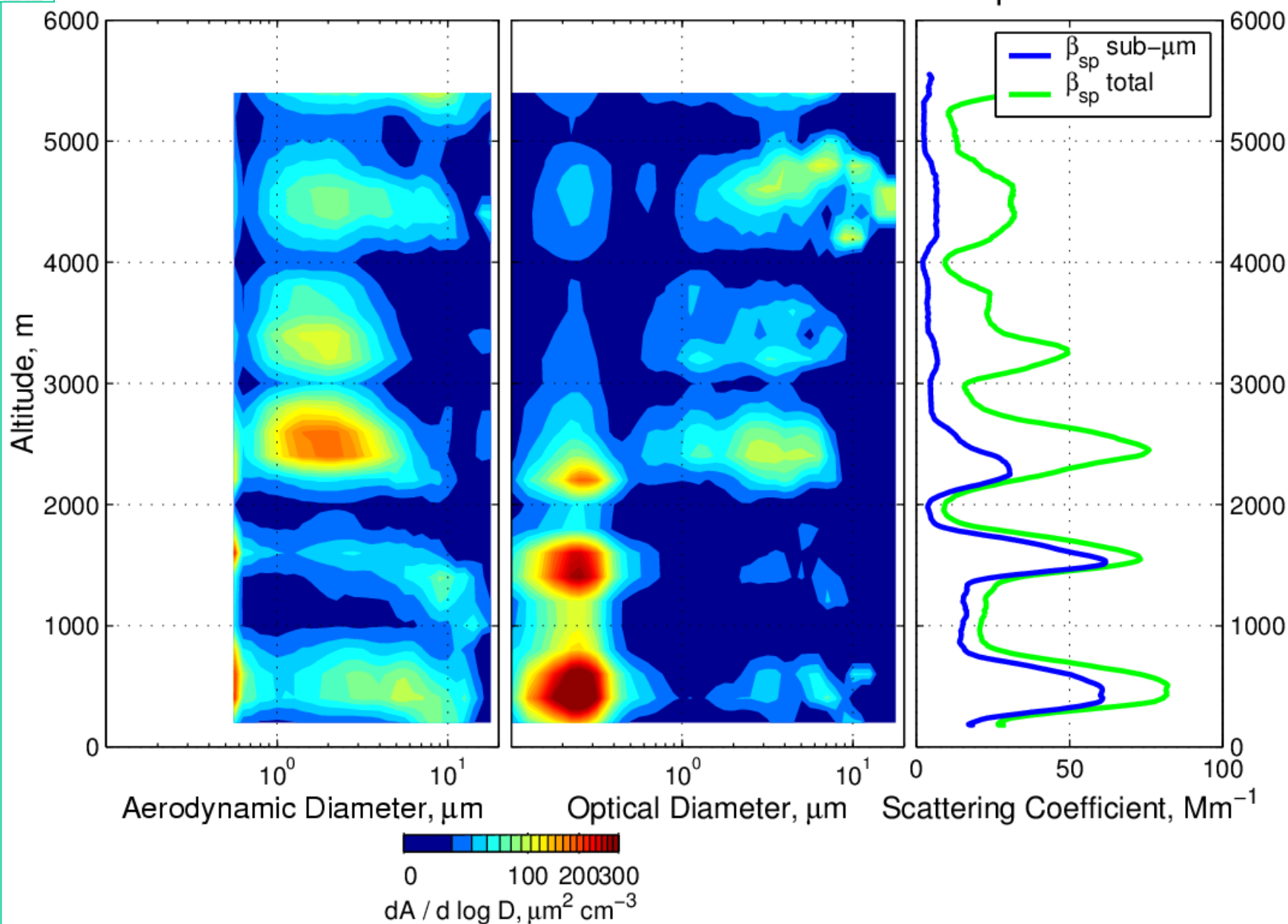
THIS ESTABLISHES A QUANTITATIVE INTERPRETATION OF REMOTE SENSING IN TERMS OF OUR ACE-TRACE OBSERVATIONS THAT MAY BE USED OVER EXTENDED SPATIAL AND TEMPORAL SCALES

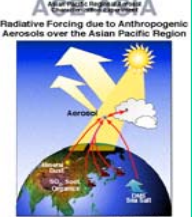


APS

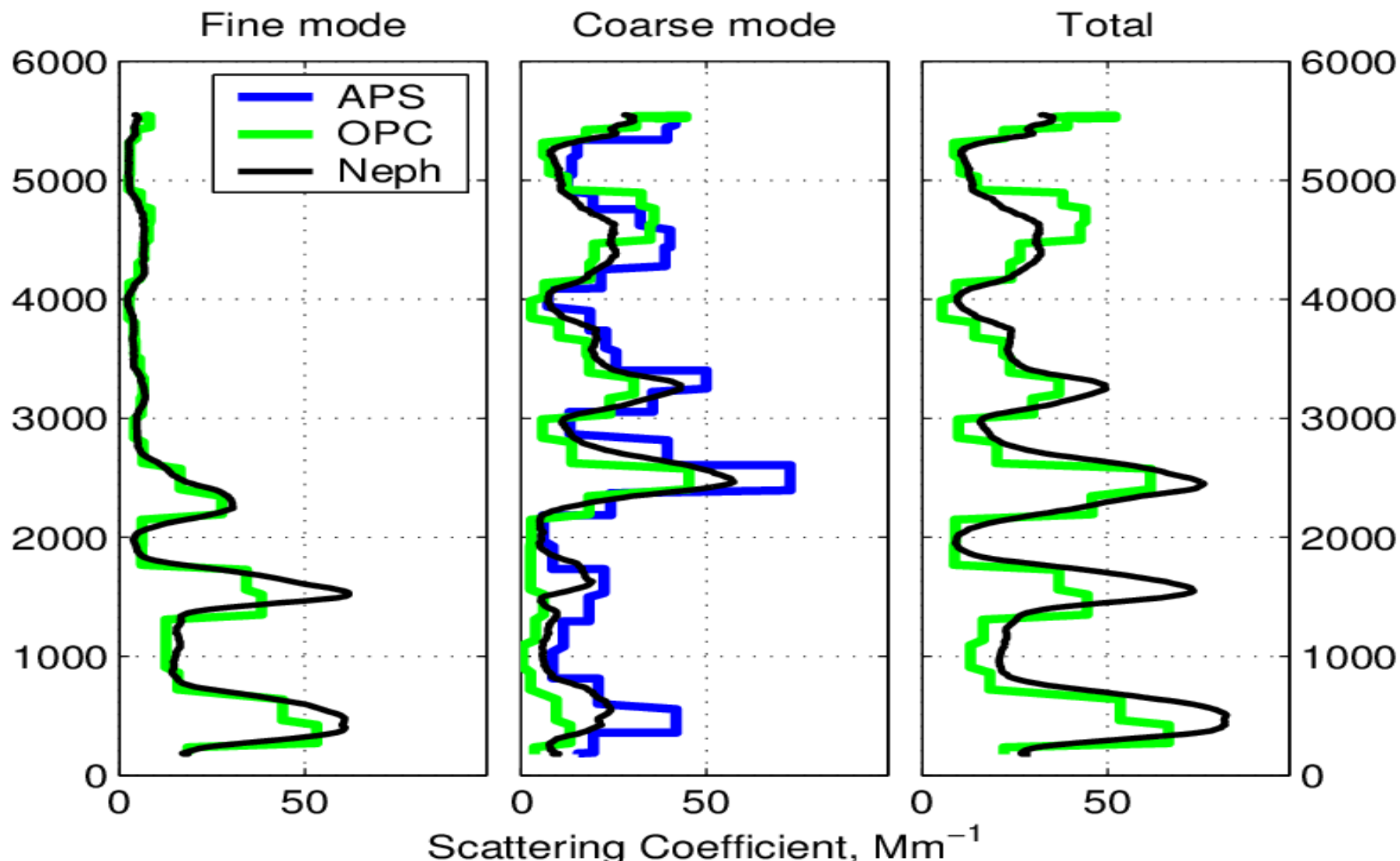
OPC

Nephelometers

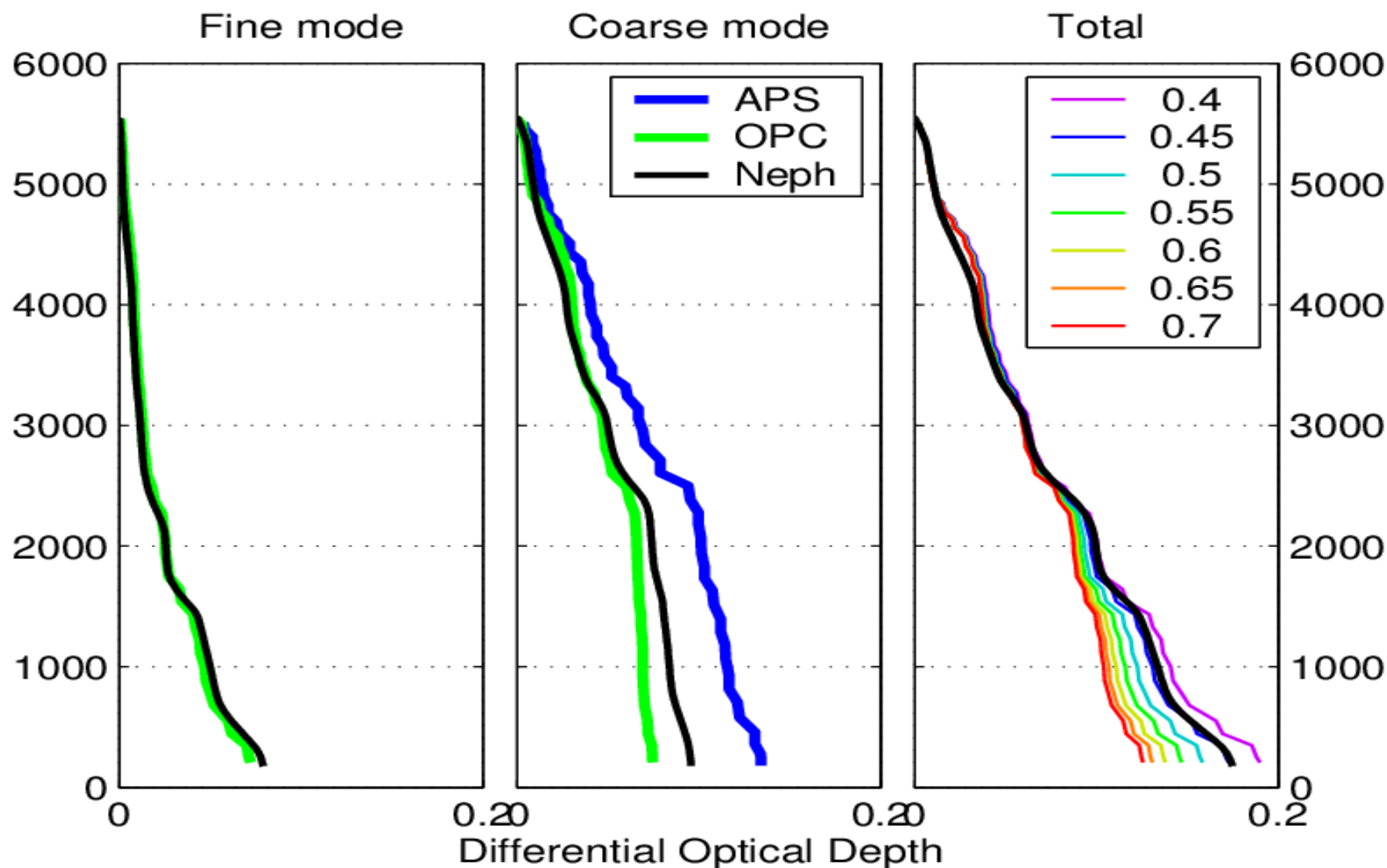




Scattering Calculated From Size Distributions



Optical Depth Calculated From Size Distributions





ACE-Asia Column Closure Profile (Preliminary) – March 2001

Dust Aloft with Pollution and Dust Below

S. Howell, A. Clarke, S. Masonis & T. Anderson

NUCLEATION ASSOCIATED WITH POLLUTION PLUMES

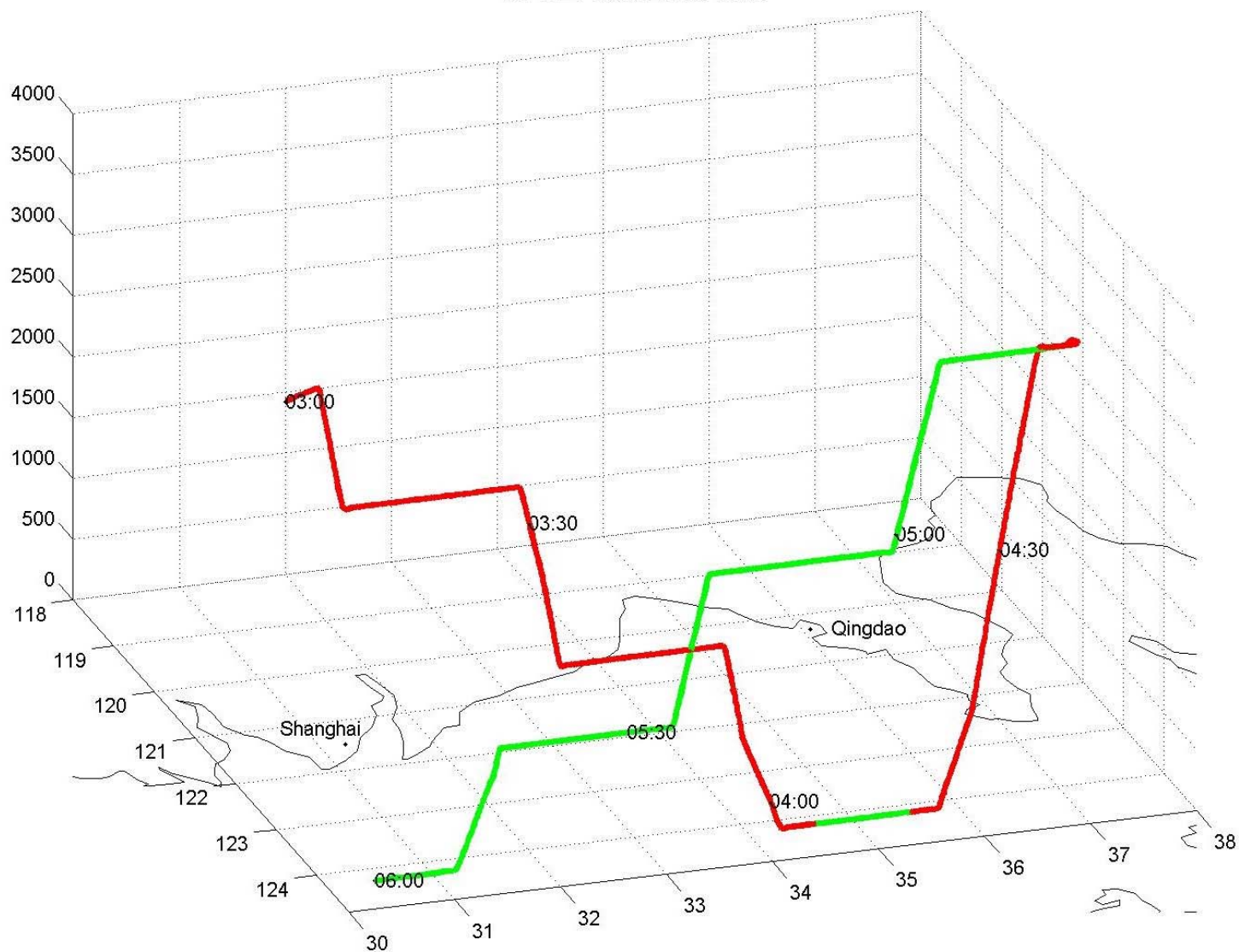
Unlike most of our PEMT-A and PEMT-B flights the data on Flight 14 and many other flights on TRACE and ACE appeared to show recent nucleation in the region of elevated aerosol concentrations.

This suggests supersaturations with respect to some species that were high enough for nucleation in spite of high surface areas.

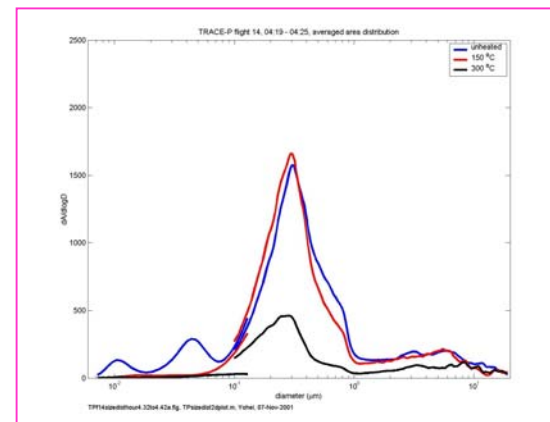
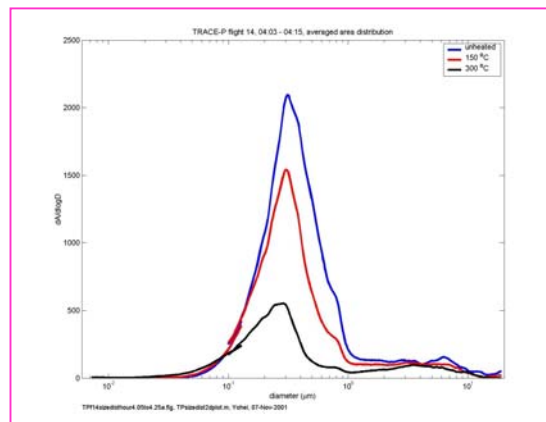
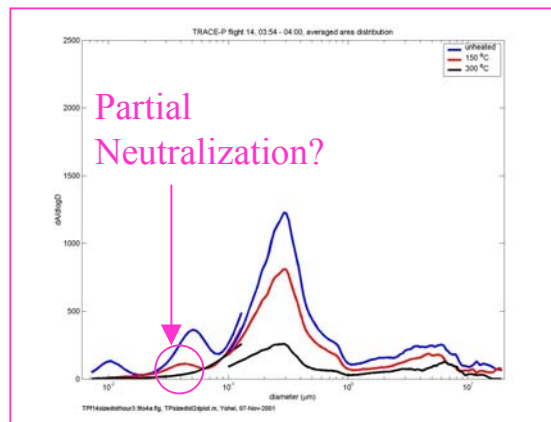
These data will provide interesting opportunities to examine the nature and evolution of newly formed particles in a polluted environment.



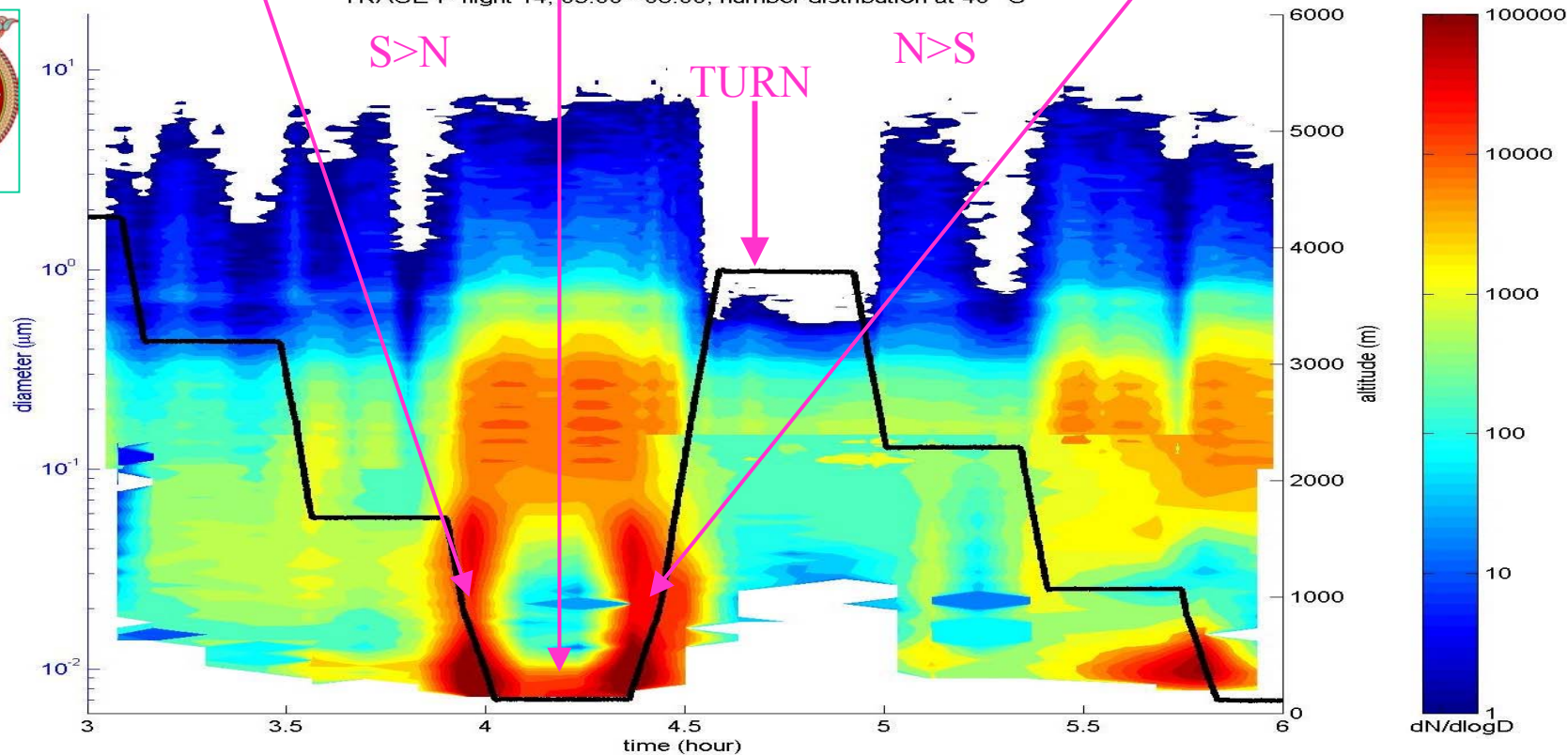
TRACE-P flight 14 near China



TRACE FL14 (April 2, 2001) Three Area distributions from Number distribution plot

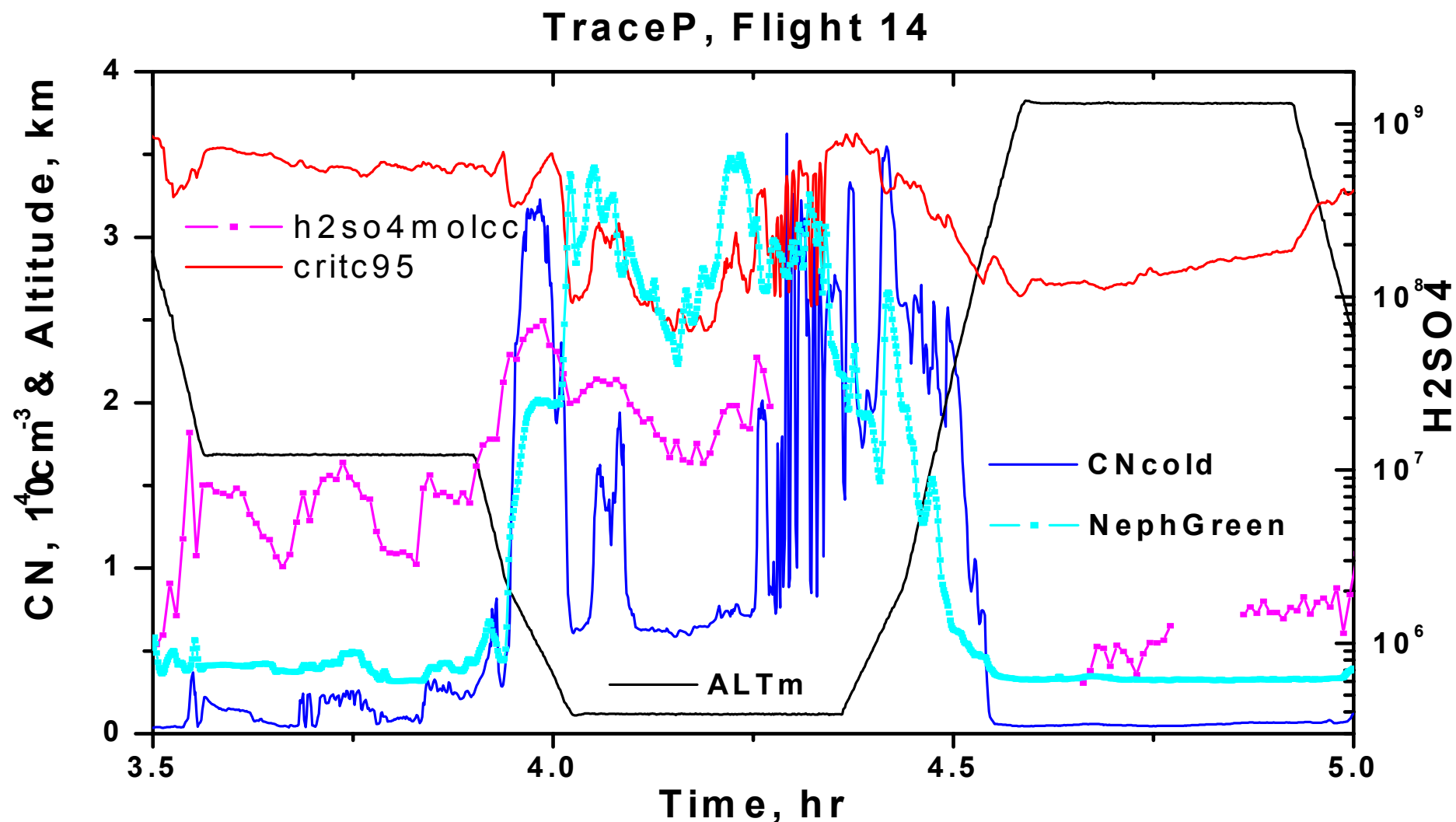


TRACE-P flight 14, 03:00 - 06:00, number distribution at 40 °C





Time series of CN, sulfuric acid and predicted sulfuric acid needed for nucleation show similar structure through low level plume with higher CN to aerosol mass (scattering) near plume top mixing region.

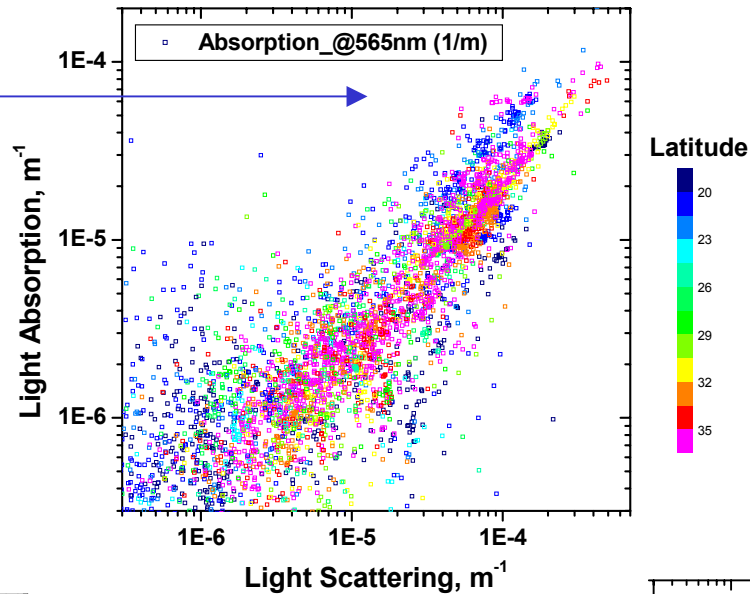


**The following are very
exploratory comparisons to
various preliminary data in
order to suggest possible
interesting regional aerosol-gas
characteristics**

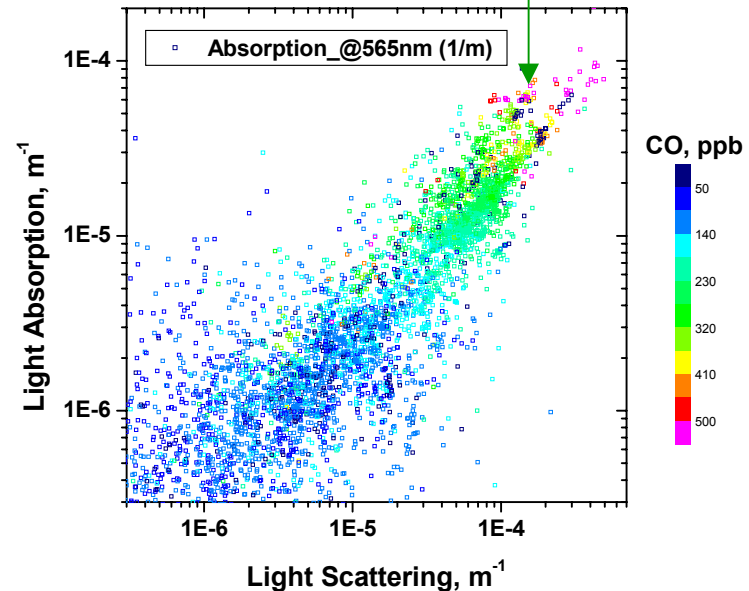
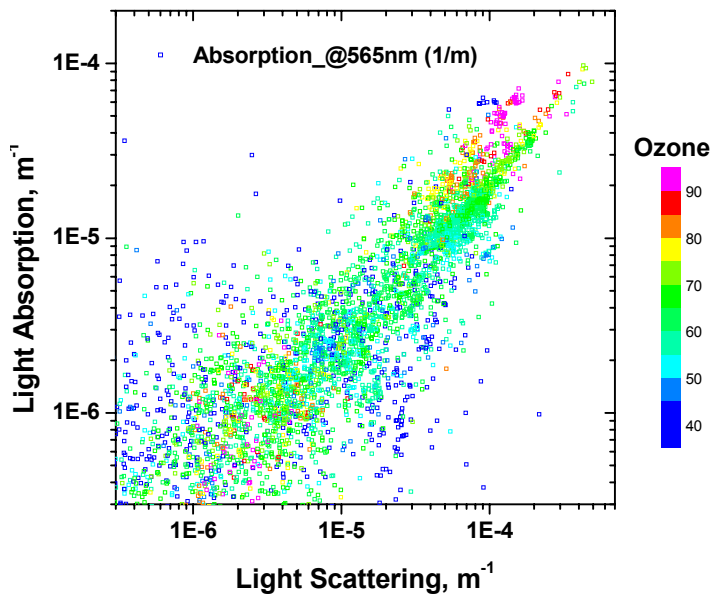
Some exploratory Regional Observations – all TRACE flights in Asia

In regions of most intense plumes (high scattering) the more southern latitudes suggest higher absorbing fraction (soot).

And a higher ozone concentration.

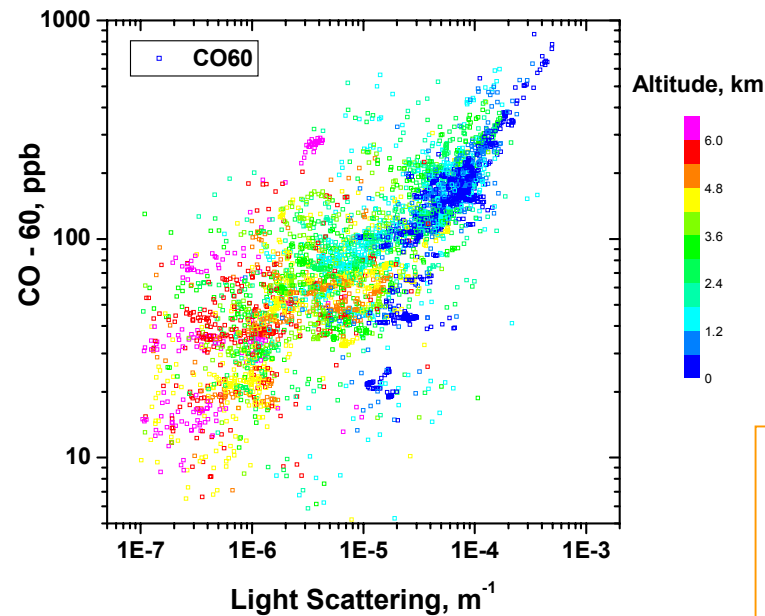


But CO concentrations are similar

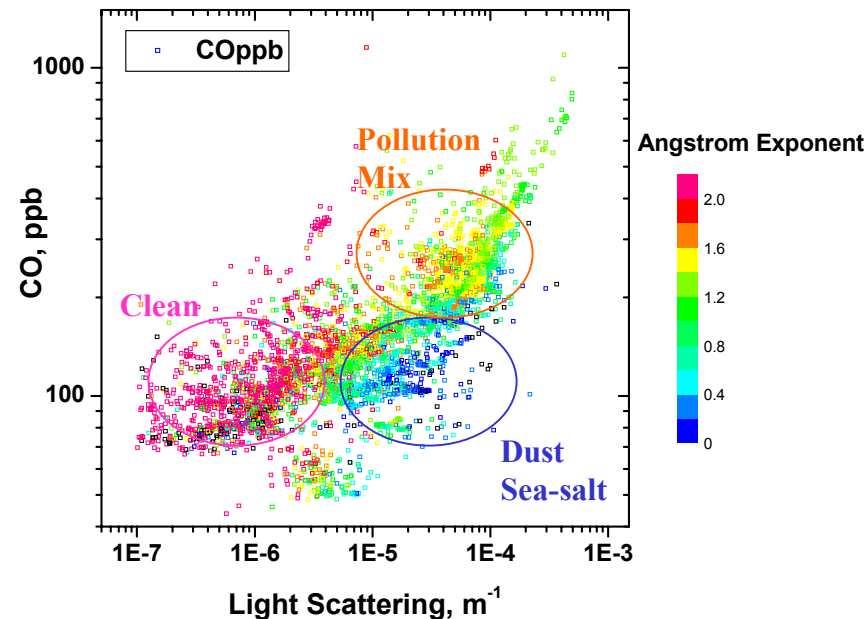
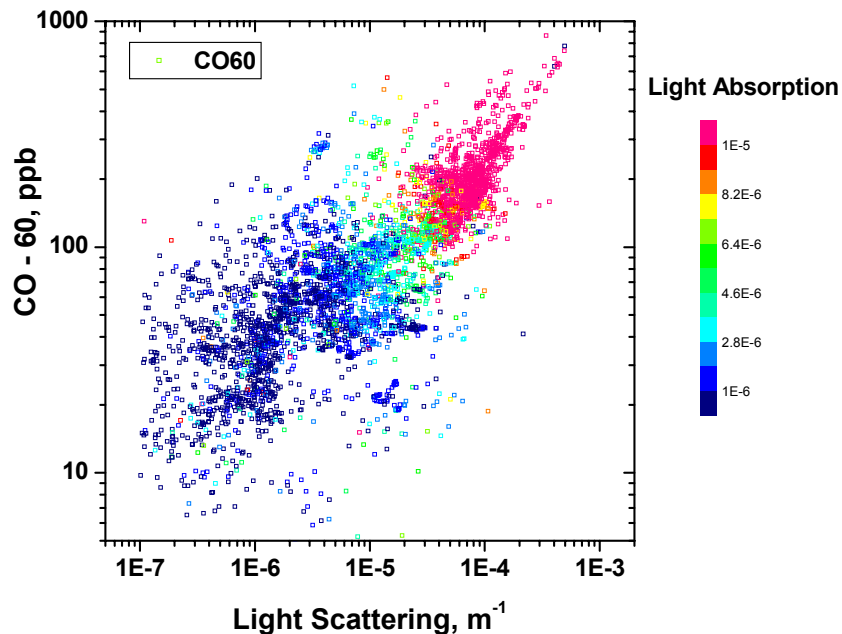


Some exploratory Regional Observations – all TRACE flights in Asia

Elevated CO and aerosol light scattering are closely related



Wavelength dependence of scatter is linked to aerosol types



SUMMARY

- Very good agreement between TRACE and ACE aerosol data indicates both data sets can be effectively combined.
- Aerosol-gas comparisons on TRACE and aerosol-radiation measurements on ACE should provide valuable cross experiment interpretations.
- Good agreement between measured and modeled physiochemical and optical properties suggests effective links to both model and satellite products.
- New opportunities to challenge our understanding of nucleation, evolution and physiochemistry are evident in the data.

AREAS OF INTEREST for Papers

Combined TRACE-ACE data when possible

- Quantitative links of in-situ aerosol data to **model**, **lidar** and **satellite** products for both validation objectives and to extend our spatial and temporal scales of measurements and interpretation.
- Improve understanding of Asian aerosol physicochemistry, optical properties and aerosol growth [$f(\text{RH})$] through assessments of volatile/refractory fractions, soluble species, absorbing fractions and coarse/fine aerosol scattering for various source regions, altitudes etc.
- Aerosol nucleation and aerosol evolution issues.
- Investigation of gas/aerosol relationships in diverse regional plumes and in conjunction with above characterization.